Metals Review

The News-Digest Magazine

Published by the American Society for Metals

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Matthew A. Hunter
A.S.M. Gold Medalist—1959
(See Article, p. 4)

September 1959

The 14th METALLOGRAPHIC EXHIBIT

Chicago, November 1 to 6, 1959

All metallographers—
everywhere—
are cordially invited to
display their best work.

RULES FOR ENTRANTS

Exhibitors do not need to be members of the American Society for Metals.

Work which has appeared in previous metallographic exhibits held by the American Society for Metals is unacceptable.

Photographic prints should be mounted on stiff cardboard, extending no more than 3 in. beyond edge of print in any direction; maximum dimensions 14 by 18 in. (35 by 45 cm.). Heavy, solid frames are unacceptable.

Entries should carry a label on the *face of the mount* giving:

Classification of entry.
Material, etchant, magnification.

Any special information as desired.

The name, company affiliation and postal address of the exhibitor should be placed on the *back of the mount* together with a request for return of the exhibit if so desired.

Entrants living outside the United States should send their micros by first-class letter mail endorsed "Photo for Exhibition—May Be Opened for Customs Inspection".

Exhibits must be delivered before Oct. 15, 1959, either by prepaid express, registered parcel post or first-class letter mail, addressed:

Metallographic Exhibit
American Society for Metals
53 W. Jackson Blvd.
Chicago 4, Ill., U.S.A.

CLASSIFICATION OF MICROS

Class 1. Cast irons and steels
Class 2. Carbon and alloy steels (wrought).
Class 3. Stainless steels and heat resisting alloys.
Class 4. Aluminum, magnesium, beryllium, titanium and their alloys.
Class 5. Copper, nickel, zinc, lead and their alloys.
Class 6. Uranium, plutonium, thorium, zirconium and reactor fuel and control elements.
Class 7. Metals and alloys not otherwise classified.
Class 8. Series showing transitions or changes during processing.
Class 9. Welds and other joining methods.
Class 10. Surface coatings and surface phenomena.
Class 11. Slags, inclusions, refractories, cermets and aggregates.
Class 12. Electron micrographs.
Class 13. Results by unconventional techniques.
Class 14. Color prints in any of the above classes. (No transparencies accepted.)

AWARDS AND OTHER INFORMATION

A committee of judges will be appointed by the Metal Congress management which will award a First Prize (a medal and blue ribbon) to the best in each classification. Honorable Mentions will also be awarded (with appropriate medals) to other photographs which in the opinion of the judges closely approach the winner in excellence. A Grand Prize, in the form of an engrossed certificate and a money award of $500 from the Adolph I. Buehler Endowment will also be awarded the exhibitor whose work is judged best in the show, and his exhibit shall become the property of the American Society for Metals for preservation and display in the Society's national headquarters.

All prize-winning photographs will be retained by the Society for one year and placed in a traveling exhibit to the various Chapters.

41st NATIONAL METAL CONGRESS & EXPOSITION

INTERNATIONAL AUDITORIUM — — — CHICAGO — — — NOV. 1 to 6, 1959

Metals Review

The News Digest Magazine

September, 1959
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Matthew A. Hunter

A.S.M. Gold Medalist—1959

The recipient of the 1959 Gold Medal of the American Society for Metals, Matthew Hunter, well-known dean emeritus of Rensselaer Polytechnic Institute, is being honored by the Society in recognition of the devotion of a lifetime to advancing metallurgical education and the ingenuity with which he has applied science to the problems of the metal industries.

In 1902, when Matt Hunter left his birthplace, New Zealand, with a M.S. degree, and headed for the universities of Europe, he had not the slightest inkling that he would not go back to New Zealand and make a career in teaching and research there. His plans underwent a drastic change when he met, in Germany, a young American post-graduate student from Greenfield, Mass. Her name was Mary Pond and she consented to marry him only when he promised to come to the United States with her. So after three years spent in England, France and Germany acquiring his Ph.D., Dr. Hunter finally landed in Boston. An impecunious alien, he had to get a job quickly—his first employment was with Professor Hulett of Princeton, working on standard cells, and then he went with General Electric Research Laboratories.

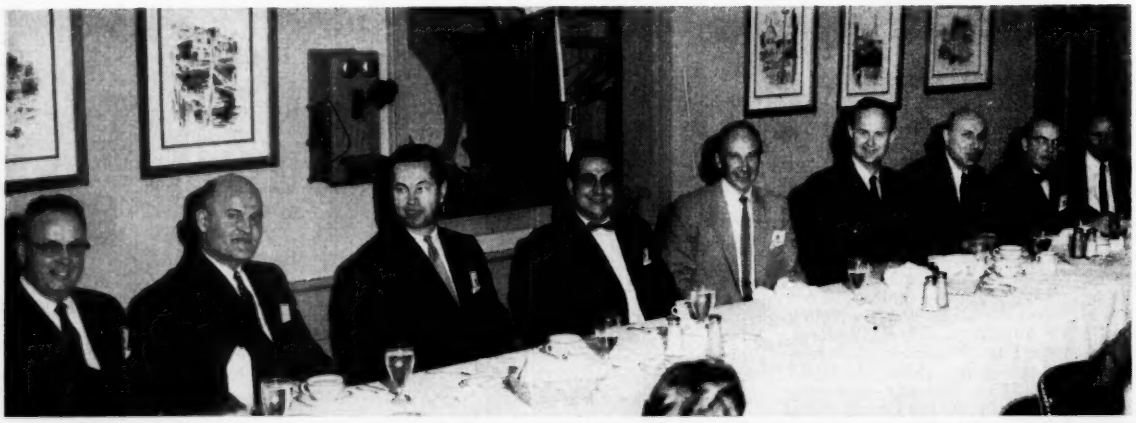
General Electric was interested in finding a wire filament that would resist melting at high temperatures. Metallic tantalum had been produced in wire form, but the other refractory metals—tungsten, molybdenum and titanium—had not. Though tungsten and molybdenum were available in high-purity forms, they could not be drawn into wire by the processes then known. This left titanium, which had not even been produced in pure form. Dr. Hunter was assigned the project of producing titanium metal. There were great hopes for this metal, particularly since it was reputed to have a melting point of 6000° C. So, nearly half a century before titanium was discovered by industry, Dr. Hunter performed the experiments and processes that are being paralleled today by another generation of scientists. The first success came in October 1906 when titanium tetrachloride was reduced with sodium. When the results of this and later experiments showed that titanium had a much lower melting point than hoped for—it ranged around 1800° C.—there was a great deal of disappointment and Matt was put on another project.

Due to the recession of 1907, General Electric was forced to cut back on expenditures. In those days the easiest place to cut back was in research, and so a number of scientists were given the opportunity of finding other jobs. Matt was among them. He found his place as a professor of electrochemistry at Rensselaer where he remained until his retirement in 1949. He organized the metallurgical engineering curriculum in 1933 and became head of the department of metallurgical engineering in 1935. In 1943 he was made dean of the faculty.

The duration of the first world war was an extremely busy period in Matt's life. The United States had no reserves of the precision alloys supplied to us by Germany, and we didn't know how to make them. So research began at Rensselaer, in cooperation with Leeds and Northrup Co., with Dr. Hunter acting as consultant. Within a short time the progress made enabled them to call the Driver-Harris Co. to provide wire drawing and strip rolling facilities. This was the beginning of an association that has lasted for more than 40 years—the length of time Matt Hunter has been chief consultant and director of research for Driver-Harris.

Dr. Matthew Hunter, the A.S.M. Gold Medal Award Winner for 1959, is another reason the American Society for Metals has every right in the world to be proud of its distinguished membership.

Columbus-Cincinnati-Dayton Chapters Meet



Present at the Tri-Chapter Meeting Sponsored by Columbus-Dayton-Cincinnati Chapters, Were, From Left: F. L. Whitney, Monsanto Chemical Co.; Dale J. Wright, Caterpillar Tractor Co.; A. deS. Brasunas, Director, Metals Engineering Institute; T. L. Chase, Chairman of the Columbus Chapter; Stan Paprocki, Chairman of the Tri-Chapter Meeting; P. L. Hill, Colonel, U.S.A.F.; Stuart Lyman, Assistant Chairman, Tri-Chapter Meeting; Fred Robertshaw, Chairman, Cincinnati Chapter; Walter Ridd, Chairman of Dayton Chapter. Absent when the photo was taken were A. Amorosi, Atomic Power Development Associates, D. L. McBride, U. S. Steel Corp. and Woody Hayes, head football coach, Ohio State University, the coffee speaker at the dinner meeting

A.S.M. Board Meets at New Headquarters

Trustees of the American Society for Metals Met at the New Headquarters Building for the First Time During Their Annual Summer Meeting, Held Aug. 23-25, 1959. Present were, from left: Evelyn G. Gardner, secretary to the Board; R. H. Aborn, treasurer; R. J. Raudebaugh, nominee for treasurer; E. E. Stansbury, trustee; C. H. Samans, nominee for trustee; E. R. Parker, trustee; G. M. Young, past-president; C. H. Lorig, president; W. A. Pennington, nominee for vice-president; M. A. Scheil, trustee; A. H. Fairchild, nominee for trustee; J. H. Hollomon, trustee; W. E. Jominy, secretary; W. Crafts, vice-president; and A. R. Putnam, A.S.M. managing director

Trustees of the American Society for Metals met for the first time in the board room of the Society's new headquarters office building Aug. 23, following brief key presentation ceremonies marking occupancy of the new structure. This was the first meeting in their annual three-day summer session.

Thirteen incumbent and newly nominated members of the board attended the meeting. Chairman was Clarence H. Lorig, A.S.M. president. In addition to Dr. Lorig, technical director, Battelle Memorial Institute, the meeting was attended by Walter Crafts, A.S.M. vice-president, and associate director, technology, Union Carbide Metals Co., R. H. Aborn, A.S.M. treasurer, E. C. Bain Laboratory for Fundamental Research, Walter E. Jominy, A.S.M. secretary, consultant, Chrysler Corp., G. MacDonald Young, A.S.M. past president, technical director, Aluminum Co. of Canada.

Trustees attending were: Earl R. Parker, professor of metallurgy, University of California, M. A. Scheil, director of metallurgical research, A. O. Smith Corp., J. H. Hollomon, manager, metallurgy and ceramics research, General Electric Research Laboratory, and E. E. Stansbury, professor of metallurgical engineering, University of Tennessee.

Nominees present included: for vice-president, W. A. Pennington, professor of metallurgy, University of Maryland, and for treasurer, R. J. Raudebaugh, supervisor, iron-nickel alloys, International Nickel Co.

Attending candidates for trustee were A. H. Fairchild, senior staff engineer, metallurgist, Western Electric Co., and C. H. Samans, associate director, engineering research, Standard Oil Co. (Ind.)

The new board room is highlighted with an expansive walnut conference table set on a steel and titanium pedestal. Comfortable chairs, styled in the contemporary manner, add muted blue accents.

Following an hour's executive session, the trustees adjourned to inspect the other areas of the new headquarters building which was nearing readiness for final staff occupancy.

Moving to a New Location?

Affiliate With a Nearby Chapter

Many A.S.M. members assume that when they move from one city to another that their A.S.M. membership is automatically transferred. This is not correct. The individual member is required to request in writing that his membership be transferred to a new chapter when he moves.

If you have moved, or contemplate moving, why not affiliate with the chapter nearest you? If you are not sure where the nearest chapter is, write to headquarters:

American Society for Metals
Metals Park
Novelty, Ohio

M.E.I. Accredited by National Home Study Council

Metals Engineering Institute, the home study division of the American Society for Metals, has just become the 39th home study school to be accredited by the Accrediting Commission of the National Home Study Council, Washington, D. C. It has been estimated that there are approximately 470 private home study schools in the U. S. M.E.I. has recently undergone a rigorous investigation and was found to meet the high standards for accreditation which have been established by the National Home Study Council.

This N.H.S.C. accrediting commission has been recognized by the U. S. Office of Education as the designated accrediting agency for private home study schools. Serving on the accrediting commission are distinguished educators such as Herold C. Hunt, Eliot Professor of Education at Harvard University, and John W. Studebaker, former U. S. Commissioner of Education.

John C. Villaume, president of International Correspondence Schools, Scranton, Pa., and a member of the N.H.S.C. Accrediting Commission came to Novelty, Ohio, and presented the Accreditation Certificate to Ray Putnam, A.S.M.'s managing director, and Tone Brasunas, M.E.I.'s director (see photo). This occasion coincided with the fall meeting of the A.S.M. Board of Trustees who attended the presentation ceremony and commended M.E.I. for its achievement.

"The accrediting of the Metals Engineering Institute by the Accrediting Commission of the National Home Study Council is a stimulating tribute, and the American Society for Metals is pleased to be so recognized", said Mr. Putnam.

The National Home Study Council is an organization of the ethical and more serious minded home study schools in the United States. This organization was started in 1926 in an effort to raise home study standards and combat the adverse behavior of numerous unethical correspondence schools that were more interested in getting enrollments and making money than in providing an educational service to their enrollees. The small number of schools presently affiliated with N.H.S.C., though representing only 10% of the schools in existence, account for approximately 85% of the volume of home study activity.

Accreditation by the N.H.S.C. Accreditation Commission means that an accredited school has met certain rigid standards and that an extensive study has been made of its operation. Furthermore, its entire set of files have been opened to a thorough investigation by an outside committee and the school has also submitted its instructional material to a careful study by competent subject matter specialists.

Accreditation means that M.E.I. has met the following standards:

- It has a competent faculty.
- It offers educationally sound and

Accrediting Commission

NATIONAL HOME STUDY COUNCIL

THIS IS TO CERTIFY THAT

Metals Engineering Institute

has been duly examined and found to meet the Educational, Ethical, and Financial Standards required for accreditation by the Accrediting Commission of the National Home Study Council.

IN WITNESS WHEREOF, we, the undersigned, by order of the Commission, have hereunto affixed our signatures this twenty-fourth day of July 1959, at Washington, D. C.

William Bethke
Chairman, Accrediting Commission

Lawrence W. Tese
President, National Home Study Council

Herold C. Hunt
Vice Chairman, Accrediting Commission

Robert Allen
Executive Secretary, Accrediting Commission

MEMBERS AND OFFICERS OF THE COMMISSION

Earl L. Bedell
William Bethke
Edward C. Estabrooke
Herold C. Hunt
William A. Rogers
J. Morrison Smith
Jack C. Stachle
John W. Studebaker
John C. Villaume

up-to-date courses.

- It admits only qualified students.
- It provides satisfactory educational services.
- It has demonstrated ample student success and satisfaction.
- Its tuition charges are reasonable.
- It truthfully advertises its courses.
- It is financially able to deliver a high quality for educational service.

In practical terms, N.H.S.C. accreditation assures its students that M.E.I. is recognized to be among the most select and reputable home study schools in the country. Such recognition makes it possible for many individuals to receive a refund for all or part of their tuition expenses since many companies, having a tuition refund plan, require that the school be accredited before allowing the tuition refund.

M.E.I. Makes Progress

During its first 2½ years of operation as a home study school, the Metals Engineering Institute of the American Society for Metals has enrolled almost 2000 students and awarded certificates to 950 men and women. Enthusiasm is high with M.E.I. students, resulting in numerous re-enrollments. One student is now working on his fifth course, another says, "I intend to study M.E.I. courses until you run out of them".

Every month about 1200 examination papers are graded and approximately 2000 letters are sent out to prospective students by the M.E.I. staff. Students have enrolled from 45 of our states, from five provinces in Canada and from 23 foreign countries. An analysis of the records indicates that the typical student is about 36 years old, married and has two children. He is employed at the technician level and has had some educational background beyond high school, mostly in the form of night school courses. However, the background of M.E.I. students ranges widely, from college professors and persons with Ph.D. degrees, to individuals who have not yet completed their high school education. Prominent among M.E.I. students are administrators, young men in production or research, salesmen, and even a few company presidents.

Although some students require as much as 1½ years to complete a course, others do it in as little as 3 months. The average time required is 9½ months, and the average grade is about 87%.

Initially, 75% of M.E.I.'s students were A.S.M. members. However, the pendulum has swung around to the other side, because of the large number of non-members enrolled, and now only 46% of the total are A.S.M. members.

John C. Villaume, Acting on Behalf of the National Home Study Council Accrediting Commission Presents the Accreditation Certificate to Ray Putnam, A.S.M. Managing Director and Tone Brasunas, M.E.I. Director

By far the most popular of the 19 available courses is Elements of Metallurgy, followed in order by Heat Treatment of Steel, High-Temperature Metals, Electroplating, Metals for Nuclear Power, Copper, Foundry Practice, and Welding. Finishing touches are now being put on several new courses, including Principles of Machining and Principles of Heat Treating. Also being readied are courses on Corrosion, Welding Fundamentals, and Testing and Inspection. The wide-spread popularity of M.E.I. is resulting in increased numbers of in-plant training programs and chapter-sponsored extension courses which are to be presented this fall.

Approximately two weeks after M.E.I. is notified of an intention to begin a course, material can be placed in the hands of a local instructor for initiating the course. M.E.I. is looking forward to an extremely busy fall.

Several inquiries have been received concerning academic credit for home study courses. A survey is being made to see to what extent this may be feasible. The results of the survey will be published in a future issue of *Metals Review*. Inquiries of all types would be welcome at the M.E.I. Headquarters Office, Metals Park, Novelty, Ohio.

President Lorig Enjoys Utah Visit

C. H. Lorig, President A.S.M., and Technical Director, Battelle Memorial Institute, and His Wife, Are Shown While Visiting the Geneva Works, U. S. Steel's Columbia-Geneva Steel Division. They are looking at the blast furnace area with snow-covered Mount Timpanogas in the background

Reviews High-Carbon Rimmed Steels

John F. Beale, Assistant Chief Metallurgist, Republic Steel Corp., Reviewed "High-Carbon Rimmed Steels" at a Meeting of Mahoning Valley Chapter. Shown are, from left: A. D. Kent; Mr. Beale; and J. G. Cutton

Speaker: J. F. Beale
Republic Steel Corp.

Members of the **Mahoning Valley Chapter** heard John F. Beale, assistant chief metallurgist, Republic Steel Corp., speak on "High - Carbon Rimmed Steel".

Mr. Beale discussed the development of pipeline which conveys the country's natural gas and petroleum. He pointed out that this manifestation of pipelines resulted from the economics and ease of transporting these materials.

As the usage of pipelines increased, higher pressures were designed into the lines and required higher strength steels. As a result, three new specifications were written by American Petroleum Institute, known as X-42, X-46 and X-52.

Higher carbon steel for electric resistance weld pipe was originally made semikilled because of the poor rimming action associated with these steels. However, the better welding characteristics associated with rimmed steel indicated it should be used.

The production of high-carbon rimmed steel presents many problems to openhearth personnel. Most of the difficulties center around the poor rimming action. The basic factors necessary to induce the required action of these steels are: high FeO in slag and metal; low sulphur; metal on cool side; and proper rim agents in mold.

Recarburizers are added to the ladle to bring the carbon content up to the order specifications. Heats are handled as quickly as possible to the soaking pits and 1 hr. delivery is the aim.

After the address, Mr. Beale was presented with the Grossman Plaque, in honor of the late Marcus Grossman, research director, U. S. Steel Corp., who died nearly seven years ago. P. T. Kelley, assistant chief metallurgist, U. S. Steel Corp., Youngstown District, received U. S. Steel's certificate representing 25-year membership in the Mahoning Valley Chapter.—**Reported by Edward J. Fromm for Mahoning Valley.**

Purdue Members Tour General Motors Plant

Members of the **Purdue Chapter** recently toured the Central Foundry (Danville Plant) of General Motors Corp. The group of about 250 members was treated to a chicken dinner at the plant cafeteria before the tour began. Following the dinner, Robert Newtson, general plant supervisor, gave an introductory talk concerning the foundry and its policies. The plant employs approximately 2100 people, only 10% of whom are salaried. Over 85% of plant output of both malleable and gray iron goes to other General Motors Divisions. Its automotive products range from small pistons to large crankshafts; its nonautomotive parts include such items as end valves and diesel parts for heavy-duty equipment. That safety is highly stressed at the Central Foundry is evident from its enviable record.

Essentially, the plant is set up on the basis of two giant production lines, one for malleable iron and the other for gray iron. Each line consists of a continuous series of operations from making the molds to trimming the excess metal from the cast part. Items such as diesel and automatic transmission parts are poured from the gray iron melts and such parts as front wheel hubs, differential cases and carriers and crankshafts are made from the malleable iron. Various nondestructive tests and finishing operations are given to the parts at the end of the lines.

A new type of iron made at Central Foundry is Armasteel, an arrested (pearlite retained) malleable product which is air-quenched and tempered rather than annealed and furnace cooled. This iron has better properties than the regular malleable for many purposes.—**Reported by Robert Russell for Purdue.**

Presents Scholarship at Muncie

The Muncie Chapter Recently Awarded Its One-Year Engineering Scholarship to Robert H. Roth, Jr., Hagerstown, Who Was Valedictorian of the 1959 Hagerstown-Jefferson Township High School. Bob had an A average for his four years in high school and was awarded an Honorary Special Merit Scholarship for being in the upper 6% of all college preparatory students in the United States. He will attend Purdue University. At the presentation were, from left: Bill Charlesworth, education committee chairman; Bob McCreery, chairman; Louis Moschell, Hagerstown principal; and Robert Roth, holding the scholarship award certificate

San Francisco to Be Site Of 1960 Metals Conference

San Francisco has been selected as the site for the American Society for Metals' 1960 Golden Gate Metals Conference, to be held Feb. 4-6, at the Fairmont Hotel. The meeting is "an outgrowth and extension of the highly successful 1958 "Welding, Brazing and Heat-Treating Conference", according to R. C. Bertossa, conference coordinator.

Two innovations will be exhibit booths for industry and a broadened technical content. Booth arrangements are being supervised by Norman McLeod.

The technical content has been expanded "due to the success of the 1958 meeting and the industrial growth of the West which has placed a new emphasis on metallurgy", said Robert Huggins, technical program chairman and a member of the Stanford University faculty.

Invited papers will deal with: new methods for processing and forming materials; high-strength steels; materials problems related to the electronics industry; brazing of metals and ceramics; cryogenics applications; and materials problems encountered in the chemical, petroleum and missile industries.

For further particulars as they become available, write to the Golden Gate Metals Conference Secretary, American Society for Metals, 2020 Milvia St., Berkeley, Calif.

Reviews N.A.S.A.'s Space Objectives at Tri-City

Speaker: J. F. Victory
N. A. S. A.

John F. Victory told the **Tri-City Chapter** at a meeting held at Rock Island that Russia's educational program is being pushed with the zeal, unity and determination of the early Christians; that its objective is world leadership in those branches of science that directly support military power; that Russia is pulling farther ahead of the United States with each passing year in the careful selection and training of two to three times the number of graduating young scientists, physicists, mathematicians and engineers. Dr. Victory said that poor educational methods in the U. S. actually impair the natural abilities of our children to think.

As assistant to the administrator of the National Aeronautics and Space Administration, Washington, D. C., Dr. Victory was quite informative on the N.A.S.A. program for space exploration. He said that the fourth Pioneer rocket launched in Mar. 1959 passed within about 37,000 miles of the moon and traveled on, to orbit around the sun. Its payload, however, was only 13.4 lb. By the end of 1959 N.A.S.A. will have launched many more satellites and space probes of various types carrying instruments to record data on conditions outside the earth's atmosphere.

The X-15, a man-carrying research airplane, is being prepared for flight tests at altitudes above 50 miles at a speed of about 3600 mph.

Seven astronauts have been selected for special training. Each hopes to become the first man to orbit the earth in a spacecraft known as the N.A.S.A. Project Mercury.

The heart of the problem in space technology is the development of a rocket engine with 1,000,000 to 1,500,000 lb. of thrust, expected by 1963. By combining four such engines in a cluster, N.A.S.A. hopes to put a 75-ton payload into orbit by 1965, and, within another five years or so, to land a human explorer on the moon, fully equipped for a return journey to the earth.—**Reported by Bruce Allen for Tri-City.**

Reviews Hardenability Relationships

Walter E. Jominy, National Secretary A.S.M., Presented a Talk on "Hardenability Relationships" at a Meeting in Peoria. Shown are, from left: T. H. Spencer, technical chairman; Mr. Jominy; and R. H. Hays, chairman

Speaker: W. E. Jominy
National Secretary A.S.M.

The National Officers' Night meeting of **Peoria Chapter** featured a talk by Walter E. Jominy, national secretary A.S.M. Dr. Jominy briefly reviewed A.S.M. national news and the latest headquarters activities. He then gave a talk on "Hardenability Relationships", in which he showed the correlation between hardenability and cost for various alloy grades. He described the hardenability spread that was possible with a number of different alloy grades and stressed the importance of applying the proper hardenability to any particular application.

Dr. Jominy brought out the fact that nearly all automotive service problems are fatigue failures rather than impact failures and that endurance limit tests are the only valid criteria for the service life of parts. In order to improve the fatigue life of a part, a minimum of 95% martensite is necessary in the hardened area. He showed the correlation between hardenability and mass effect, and how this affected the required 95% minimum martensite. Slides were shown to substantiate his theories.

The acceptance of the Jominy hardenability test for carbon steel was also discussed. Even though the shallow hardening carbon steels do not easily lend themselves to any hardenability test, the Jominy test appears to be the standard preferred by most laboratories and has recently been recognized and accepted by S.A.E.—**Reported by D. R. Harbers for Peoria Chapter.**

Speaks on Magnetic Uses

Speaker: W. Eberly
Carpenter Steel Co.

Warren Eberly, metallurgist — special alloys, Carpenter Steel Co., spoke on magnetic alloys and specialty steels for the electronics industry in a talk entitled "Properties and Handling Techniques of Iron-Nickel Alloys for Magnetic Applications" at the meeting of the **West Central Florida Chapter.** He covered the application, fabrication and machining of these metals.

A. S. M. has produced and makes available for showing before chapters and educational institutions moving picture films pertaining to metals.

Outlines Problems of Space Travel

Shown at a Meeting of New York Chapter Are, From Left: L. Anselmini, Program Committee Chairman; K. B. Young, Supervisor of Aeronautical Applications, International Nickel Co., Inc., Who Spoke on "Materials in Space Travel"; Frank D. Malone, Chairman; S. M. Norwood, Technical Chairman of the Meeting; and A. V. Allessandria, Secretary of the Chapter

Speaker: K. B. Young
International Nickel Co., Inc.

A discussion of some of the extraordinary difficulties implicit in any attempt to propel a man-made vehicle into space and, more important, to return it again to earth, was presented to the **New York Chapter** in a talk by K. B. Young, supervisor of aeronautical applications, Application Engineering Section, The International Nickel Co., Inc., entitled "Materials for Space Travel". It was noted that even an apparently simple question such as how far above the earth's surface space begins has widely varying answers, depending upon the criteria selected. Physiological considerations place it between 5 and 12 miles; areodynamics would raise it nearer to 35 miles; and rocketry to 160 miles, the altitude above which no measurable air resistance has been detected, which is probably the most meaningful figure.

Although a velocity approaching 17,000 mph. is required for a satellite to achieve orbit and a velocity of 24,000 mph. is required for it to escape completely from the earth's gravitational pull, the problem of return rather than exit presents the greater difficulties. Thus the nose cone of an ICBM in free-fall may attain a temperature in the vicinity of 12,000° F. and metallurgical solutions involving the "heat-sink" principle have given way to solutions based upon ablation (the controlled melting and stripping off of the surface) for which certain plastics and ceramics are more suited. Of course if it is desirable to recover the vehicle intact, efforts must be made to avoid extraordinarily high speeds and the concomitant temperature extremes, and metals will be particularly useful in vehicles for manned space flight.

Mr. Young indicated that the sources of heat in a space vehicle are both internal and external. The internal source is largely engine heat and the principal external sources are:

1. Aerodynamic heating, that is, friction between the surface of the missile and the medium through which it moves. This is intensified as turbulence and air density increases.
2. Stagnation effect which results from bringing air to rest from some high velocity.
3. Radiation from the sun.

Although the strengths of most common metals drop to disappointingly low values as temperatures approach their melting points, it was emphasized that it is the combination of physical and mechanical properties which is controlling and that, for example, high thermal diffusivity and/or emissivity may partially compensate for some inadequacies in strength. Nickel was cited as an element which is not outstanding thermally or mechanically, occupying an intermediate position in the spectrum of available metals, but in certain rocket applications it has nevertheless supplied the best combination of these properties for the end use.

The importance of light weight and fabricability in addition to the foregoing were also stressed and several of the newer techniques for coping with these problems were mentioned.

The difficulties associated with the development of the X-15, considered by many to be an intermediate step in our progress toward manned space flight, were discussed, and the solution involving the use of an age hardenable nickel chromium alloy, Inconel X, for the skin and precipitation hardened stainless steels for structural components subjected to somewhat lower temperatures, was cited as a harbinger of the future material requirements for hypersonic flight.—**Reported by J. J. Moran, Jr., for New York.**

Presents Data on High-Speed Steel

Neil J. Culp, Supervisory Metallurgist, Alloy Development, Carpenter Steel Co., Spoke on "High-Speed Steels" at a Meeting Held by Springfield Chapter. He presented slides of the microstructures of various phases of several heat treatments of high-speed steel and explained desirable and undesirable formations, relating these structures to their effect in the finished product. Shown are, from left: Stuart Sinclair technical chairman of the meeting; Mr. Culp; and Roger Heroux, chairman

National President A.S.M. C. H. Lorig, Technical Director, Battelle Memorial Institute, Spoke on "Materials for This Changing World" at a Meeting of Washington Chapter. Shown are, from left: Harold Bernstein, retiring chairman; Dr. Lorig; and W. L. Holshouser, new chairman

President Lorig Speaks at Washington

Speaker: C. H. Lorig

Battelle Memorial Institute

Clarence H. Lorig, president, A.S.M., and technical director, Battelle Memorial Institute, presented a talk on "Metals for This Changing World" at a meeting of the **Washington Chapter.**

Dr. Lorig first reviewed major metallurgical accomplishments during the last ten years. The most intensive work on metallurgical research and development is presently being directed toward metals to give better performance under the extreme temperatures and stresses that are encountered, for example, in missiles and aircraft for supersonic flight. In the early stages of jet engine development, operating temperatures were limited to about 1200° F. Since then, this limitation on temperature has advanced steadily upward to the present 1650° F. Present-day research has as its goal temperatures in excess of 2500° F.

Even in the light metal industry, an endeavor is being made to provide new alloys that will have greater stiffness and much better strength properties in elevated temperature service. A new aluminum-base, age-hardening alloy designated as X-2020-T6 was recently made available in experimental quantities. It has as good or better strength, particularly at elevated temperatures, a higher modulus of elasticity and a lower density than the strongest aluminum alloys currently produced. An important addition in it is 1% lithium. The principal hardening element is copper, present in amounts of approximately 4%.

Among the new magnesium alloys is one designated as HZ-32A containing about 3% thorium, 0.75% zirconium, and 2.1% zinc. Its creep behavior is much superior to the thorium-bearing alloy, HK-31A, which contains no zinc.

From the strength-weight basis, beryllium seems to be superior to all present metals up to 1100° F. Its extreme brittleness at room temperature and its high cost are its chief drawbacks in today's engineering applications. The research efforts put on titanium to develop alloys for the manufacture of airframes and jet engines were intense over the past ten years. Yet it was almost six years before the metal was ready for use in commercial quantities. The newest titanium alloy to be developed for high-temperature applications is one containing 8% aluminum, 8% zirconium, and 1% tantalum and columbium combined. This alloy extends the useful short-time temperature range of titanium-base metals about 200 to 300° F. and offers designers additional useful strength in the range up to 1100° F.

Developments in supersonic aircraft and missile designs have been moving so rapidly they have gone beyond the present ranges of the light metals and temporarily, at least, the field is left primarily to steel. The aim is to develop steels with minimum tensile strengths of 260,000 psi. at room temperature, 200,000 psi. at 800° F., and 120,000 psi. at 1200° F. No steel today can match these requirements. Steels that are being considered fall into two categories, nonstainless and stainless. The nonstainless type includes the hot work die and the martensitic alloy steels. Stainless steel types include the martensitic, the semi-austenitic precipitation hardening, the cold rolled austenitic and the precipitation hardening austenitic steels. The latter appears to be most promising where temperatures are in excess of 1100° F.

At the conclusion of the meeting, Dr. Lorig presented 25-year membership plaques to Reginald S. Dean and to George A. Pleam. A certificate of appreciation was also presented to H. Bernstein, retiring chairman of the Washington Chapter.—**Reported by R. E. Lyons for Washington.**

New Haven Combines Tour and Talk

A Combination Plant Visit and Technical Meeting Were Enjoyed by Members of the New Haven Chapter Who Visited the Bridgeport, Conn., Plant of Carpenter Steel of New England, Under the Supervision of W. A. Schlegel, Chief Metallurgist, and Then Heard George Schad, Metallurgist at Carpenter, Speak on "Metallurgical and Design Solutions to Toolsteel Failures". Shown are, from left: Fred Storm, vice-chairman; Mr. Schad; and Art Butler, technical chairman of the meeting

Oak Ridge Presents Educational Series on Modern Research Techniques

Techniques for Measuring Physical Properties Were Discussed by Samuel Spinner (Right), National Bureau of Standards, During the Educational Series on "Modern Research Techniques" Held by Oak Ridge Chapter. Technical chairman S. D. Fulkerson is at left

A series of educational lectures entitled "Modern Research Techniques", sponsored by the **Oak Ridge Chapter,** covered major recent developments in experimental techniques for measuring residual stresses, physical properties and temperatures.

Felix Zandman, Tatnall Measuring Systems Co., discussed the methods used for studying residual stresses. The action of principal stresses and strains on a body was described and equations for determining them were presented. Several experimental methods for measuring strain were briefly reviewed, but the major emphasis of the discussion was based on the photo-elastic coating technique.

This technique is one in which the actual structure to be stress analyzed is coated with a special transparent plastic. When a load is applied, stresses are transmitted to the plastic coating, which then becomes birefringent. The birefringence is directly proportional to the intensity of strain and appears in the form of black and colored fringes when the plastic is observed through a reflection-type polariscope. The fringe pattern can thus be analyzed in static or dynamic loading conditions to reveal the exact geography of mechanical strains in the structure. Slides were utilized to illustrate typical stress patterns in pressure vessels, aircraft panels and other components. The use of the photo-elastic coating technique for determining residual stresses by the relaxation method was also discussed.

Samuel Spinner, National Bureau of Standards, discussed the use of sonic resonance techniques for the measurement of physical properties. These methods are used to determine the fundamental and overtones of the resonance frequencies of the specimens under study. An oscillator and transducer are used with suitable instrumentation to make this study. Empirical equations were presented which illustrated the relationships between the resonance frequency and the modulus of elasticity and Poisson's ratio.

Sonic techniques are extremely valuable for determining the modulus since the stresses involved are essentially nil. It is a nondestructive technique and can therefore be used to study the influence of a particular variable (e.g., radiation) on the physical properties. The procedure particularly lends itself to elevated temperature studies and several unusual effects have been noted. For example, the modulus of fused silica increases with increasing temperature up to above 1250° C.

Frank Potts, Oak Ridge National Laboratory, Instrumentation and Controls Division, spoke on problems associated with accurate temperature measurement. The fixed points on the international temperature scale were discussed, ranging from the boiling point of oxygen to the freezing point of gold. Applications of resistance thermometers and variations of wheatstone bridges were discussed. The limits of error, temperature ranges and types of atmosphere for several types of thermocouples were presented. Reasons for drift as a function of time at temperature were also covered.

Some recent methods for the measurement of temperature at 3000 to 4000° F. were described and the principles of temperature measurement by optical means were presented in detail. It is extremely important that the emissivity of the radiating body and any intervening media be known accurately if brightness is used as an indication of temperature. A two-color pyrometer, in which emissivity errors are minimized, was described.—**Reported by Gerald M. Slaughter for Oak Ridge.**

Felix Zandman (Left), Tatnall Measuring Systems Co., Who Discussed Techniques for Measuring Residual Stress During Oak Ridge Chapter's Educational Series on "Modern Research Techniques" Is Shown With Technical Chairman J. K. White, at the Meeting

Techniques for Measuring Temperatures Were Discussed by Frank Potts (Right), of Oak Ridge National Laboratory, at the Same Series of Educational Lectures Held at Oak Ridge. He is shown with D. L. McElroy, the technical chairman for this lecture

Last Activity at Old A.S.M. Headquarters

Ray T. Bayless (Right) Is Shown Next to A. Brasunas and Part of the Metals Engineering Institute Class Which Met in the A.S.M. Conference Room to Study the Course "Heat Treatment of Steel". Dr. Brasunas and Lew Berger (left), instructed the group which completed the course in a record-breaking period of 13 weeks

The old stone building on the corner of Euclid Ave. and E. 73rd St., familiar to many members as the national headquarters of the A.S.M., is now standing empty. A.S.M. has moved into its first real home, built expressly for the Society.

The first home of A.S.M. (then known as the American Society for Steel Treaters), was on the third floor of the Cook Bldg. at E. 46th and Prospect St., which Bill Eisenman moved into with a staff of two.

In 1925 Bill Eisenman and Ray Bayless gathered their growing staff into larger quarters at 7016 Euclid Ave., where they remained for 15 years. It was during this time that A.S.S.T. became A.S.M. In 1940 A.S.M. moved again, to 7301 Euclid Ave., which was soon also outgrown and overflowed into the building next door, at 7303 Euclid Ave. More recently A.S.M. has had to rent additional office space for Taylor Lyman's growing staff at Warrensville Center and Kinsman Rd., and the rapidly growing Metals Engineering Institute was moved to the second floor of a building a few miles west of the headquarters building.

The completion of the new A.S.M. headquarters building in Novelty, Ohio, has reunited the far-flung locations of the Society, including the warehouse facilities, formerly at E. 105th St. and Cedar Rd.

The above photograph was taken on July 1 to mark the last official function held at the old building before the move to the new site 20 miles east of the old location.

ADVANCED PROGRAM FOR A.S.M. SEMINAR

Chicago, Ill., Oct. 31-Nov. 1, 1959

Resonance and Relaxation in Metals

Session I

Chairman: John N. Hobstetter

Acoustic and Magnetic Resonance, by Arthur S. Nowick, IBM Research Center

Cyclotron Resonance in Metals, by John K. Galt, Bell Telephone Laboratories

Nuclear Resonance in Metals at Low Fields, by Alfred G. Redfield, IBM Watson Laboratory

Session II

Chairman: R. I. Jaffee

Ferromagnetic Resonance, by Donald S. Rodbell, General Electric Research Laboratory

The Relation of Metallic Bonding to Elastic Constants, by C. S. Smith, Case Institute of Technology

Session III

Chairman: Morris E. Fine

Dislocation Relaxation at High Frequencies, by P. G. Bordoni, University of Pisa, Italy

Session IV

Chairman: Morris Nicholson

Elastic Internal Friction Effects in Crystals and Dislocations, by James S. Koehler, University of Illinois

Large Amplitude Effects and Fatigue, by W. P. Mason, Bell Telephone Laboratories

Investigation of Radiation Damage Using Acoustics, by David K. Holmes, Oak Ridge National Laboratories

Session V

Chairman: Raymond L. Smith

Stress Induced Atom Motion, by Charles A. West, University of Illinois

Interaction of Conduction Electrons and Acoustic Waves, by Donald F. Gibbons, Bell Telephone Laboratories

Investigation of Metallurgical Phenomena Through Elastic Constants, by John M. Sivertsen, University of Minnesota

Metallurgical News and Developments

A Department of *Metals Review*, published by the American Society for Metals Metals Park Novelty, Ohio

Devoted to News in the Metals Field of Special Interest to Students and Others

Columbium Symposium — The Hudson-Mohawk Section of A.I.M.E. is holding a Columbium Metallurgy Symposium at Bolton Landing, Lake George, N. Y., June 9-10, 1960. Papers on mechanical properties, fabrication, corrosion and oxidation and general physical metallurgy are solicited. Send abstracts to D. L. Douglass, Knolls Atomic Power Laboratory, General Electric Co., Schenectady, N. Y., by Feb. 1, 1960.

Operations Research—Case Institute of Technology is offering a two-week survey of methods, techniques and tools of Operations Research. For information write: W. W. Abendroth, Program Director, Operations Research Group, Case Institute of Technology, 10900 Euclid Ave., Cleveland 6, Ohio.

Heat Transfer Conference—The Second International Heat Transfer Conference, to be held at the University of Colorado, Aug. 28-Sept. 1, 1961, is being sponsored by A.S.M.E., A.I.C.E. and the British Institutions of Mechanical Engineers and Chemical Engineers. Abstracts should be sent to: S. P. Kezios, Secretary, 1961 International Heat Transfer Conference Committee, c/o The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y., by Aug. 1, 1960.

Metallurgical Research Center — Du Pont Co. is constructing a fully equipped metallurgical research center for the development of high-temperature metals for space age uses at its Baltimore plant.

Stress Measurement Symposium — Strain Gage Readings is sponsoring a Stress Measurement Symposium on Jan. 25-29, 1960, at Arizona State University. Topics of discussion will include photo-elasticity, brittle coatings, resistance strain gages and theoretical analysis. For further details write Strain Gage Readings, 5602 E. Monte Rosa, Phoenix, Ariz.

Titanium Process — Norton Co. research workers have found a new, more economical method of producing titanium in pure form. The electrolytic process takes place in an argon atmosphere at 900° C. The anode is titanium carbide, which contains three times as much titanium but compares in price to the titanium tetra-chloride being used in present processes.

Indian Technical Meeting — The 13th annual technical meeting of the Indian Institute of Metals will be held in Bangalore, Dec. 1-5, 1959. A symposium on Structural Changes in Metals and Alloys, a metallographic contest and exhibition and the Pandya Memorial Lecture will be highlights of the program. For information write: R. D. Lalkaka, Jt. Hony. Secretary, The Indian Institute of Metals, 31 Chowringhee Rd., Calcutta 16, India.

Diffraction Conference—The 17th Annual Pittsburgh Diffraction Conference will be held Nov. 11-13, 1959, at Mellon Institute, Pittsburgh. For information write: D. W. Beard, Crucible Steel Co. of America, 234 Atwood St., Pittsburgh 13, Pa.

Zinc Soldering Process—Alcoa engineers find that a zinc soldering process for joining aluminum to itself and other metals is superior to brazing for the bonding of thin complex sections, socketed tube joints and dissimilar metal transition joints. Fluxes used are less expensive and easier to remove than brazing fluxes and are used at lower temperatures, permitting joining of aluminum and copper.

Electrolytic Metals—The Manganese Chemicals Corp., Rand Tower, Minneapolis 2, Minn., has available in test quantities electrolytic titanium and chromium crystals and new alloys of these electrolytic metals.

Vanadium Additive—Chicago Development Corp., Riverdale, Md., has announced a new intermediate alloy, CDC VAN-AD, which gives greater strength and hardness to titanium alloys. It is about 75% vanadium, balance titanium and a small percentage of other metals.

Electron Beam Welder—NRC Equipment Corp., 160 Charlemont St., Newton 61, Mass., has developed an electron beam welder with a gun fully protected from gaseous discharges in the weld area. The electron beam evaporates impurities from the weld area as the bead is formed, makes a better bead, has a smaller heat affected zone and gives a smaller width to depth ratio and excellent penetration.

Instrument and Control Industry Brochure—The Scientific Apparatus Makers Assoc. has published a revised edition of the leaflet "Your Career With the Instrument and Control Industry". Copies are available from: Horace M. Byrnes, executive secretary, Recorder-Controller Section, Scientific Apparatus Makers Assoc., 370 Lexington Ave., New York 17, N. Y.

A.S.M. Chapters Plan Visits to New Building

First requests by chapters to inspect the new headquarters building have come from the Akron and Cincinnati Chapters of the American Society for Metals. The building is located on Ohio Route 87, two miles east of Ohio Route 306, in Russell Township, Geauga County.

Pleased with this early evidence of interest by these chapters, Allan Ray Putnam, A.S.M.'s managing director, is inviting other chapters to follow suit.

Members of the Akron Chapter will visit Sept. 16. R. M. Moore is chapter chairman. Cincinnati Chapter members will then be entertained Oct. 17. Chairman is Albert J. Pfetzing.

First Cleveland organization to plan an inspection trip is the industrial committee of the Cleveland Advertising Club, which has announced an Oct. 15 visit to the building. Some 50 Greater Cleveland advertising and industrial sales executives will make the trip.

ROBERT H. MOONEY, works engineer, Central Foundry Division, General Motors Corp., was presented an "Award of Scientific Merit" by the American Foundrymen's Society, based on his "technical contributions to production and working conditions in the malleable iron industry".

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GILBERT TINT, formerly chief engineer for Alcar Instruments, Inc., is now vice-president and chief engineer, National Ultrasonic Corp.

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GEORGE F. PAULUS, specialist on protective coatings for heat-sensitive surfaces, has joined the research and development staff of Acheson Colloids Co., as a product development chemist.

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JACOB J. WALTER has been appointed refractories engineer by Norton Co., with headquarters at Philadelphia. He will cover the District of Columbia, Delaware, Virginia, eastern Pennsylvania and parts of Maryland and New Jersey.

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A. LORING ROWE is now vice-president and secretary of La Salle Steel Co. His duties will include supervising the company's purchasing, planning, office services, finance and accounting departments.

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WALTER JEHU has been named managing director of Australian Timken Proprietary Ltd. He and his wife will make their home in Ballarat, Australia.

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GEORGE LA MONTE WEISSENBURGER, formerly president and treasurer of Keokuk Electro-Metals Co., which was recently merged into the Vanadium Corp., is now a member of the board of directors, Vanadium Corp. of America.

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DANIEL A. PORCO, formerly manager of the Corporate Development Section, now holds the newly created position of assistant to the president with Crucible Steel Co. of America. ROBERT B. HEWETT, chief industrial engineer, has been named to fill the post vacated by Mr. Porco, and GEORGE I. ZIDERS, works industrial engineer at the Sanderson-Holcomb plant, replaces Mr. Hewett as chief industrial engineer.

Explains Western European Metallurgy

Oleg D. Sherby (Center), Associate Professor of Metallurgy, Stanford University, Gave His Impressions of "Metallurgy in Western Europe" at a Meeting of Santa Clara Valley Chapter. He is shown with Ed Wright (left) and Malcolm Davis (right), participants in the monthly meeting

Speaker: O. D. Sherby
Stanford University

Oleg D. Sherby, associate professor of metallurgy, Stanford University, spoke on his impressions of "Metallurgy in Western Europe" as seen from his post as scientific liaison officer at the London Branch of the United States Office of Naval Research where he was recently attached, at **Santa Clara Valley.**

Dr. Sherby discussed some of the differences between the educational requirements as well as the differences in means of financing the education of metallurgists in the various countries. He also pointed out four of the research areas where emphasis is now being placed—fatigue, metal whiskers, thermodynamics of metals and lattice vacancies and other point defects on mechanical behavior. While he did not indicate that emphasis was being limited to these areas, they were areas in which outstanding work is currently being done in Western Europe. His contacts also indicated to him some important unique aspects in metallurgy activities in Western Europe, such as the Max Planck Institutes in Germany, the Travel Pre-Doctoral Fellowships in Holland, the Basic Metallurgical Committee setup in Great Britain and the fine cooperation between universities and industries in the Paris area.

At the conclusion of Dr. Sherby's presentation, he was besieged with miscellaneous questions involving some of the areas which he discussed. —**Reported by Robert N. Johnson for Santa Clara Valley.**

Talks on Vacuum Melted Steels

"Quality Aspects of Vacuum Melted Steels" Were Discussed by William W. Dyrkacz, Manager of Quality Control, Watervliet Works, Allegheny-Ludlum Steel Corp., at a Meeting in Worcester. Shown are, from left: G. L. Durfee, technical chairman; Mr. Dyrkacz; and L. Krasnow, chairman

Meet Your Chapter Chairman

COLUMBUS

JOHN G. KURA, chief of the research division, Battelle Memorial Institute, has been closely associated with research on problems in nonferrous metallurgical engineering since 1942, when he joined Battelle. He holds a patent on an inert mold material for casting titanium and is co-inventor of Alumoweld, a high-strength steel clad with aluminum, for use in electrical power transmission lines. Mr. Kura's contributions to technical literature consist of 34 papers and articles, including a chapter on titanium in the A.F.S. Cast Metals Handbook.

Mr. Kura was born in Pittsburgh and received his B.S. degree in metallurgical engineering from Carnegie Institute of Technology, where he later did graduate work on alloy steels. He is active on the A.S.T.M. committees on copper and copper-base alloys, and the A.F.S. committee on titanium and reactive metals.

Hobbies consist of golfing and fishing with his two sons when he finds time to relax from his other two hobbies, shrubbery horticulture and woodworking. Because of the latter hobby, much of his spare time is currently being applied to finishing his new home. He actively follows the interests of 6-year old Randy and 14-year old Jimmy, but wisely lets his wife Pat handle the involvements associated with teen-age Shari.

SYRACUSE

THEOPHILUS A. CROSBY, sales engineer with Whitehead Metals, Inc., was born in Nova Scotia. He was a staff sergeant in the Army Air Force during World War II, serving as flight engineer in the B-24 Eighth Air Force in England. Recalled to active service in 1950, he served in Japan for a year and he is now in the Inactive Reserve.

Mr. Crosby's educational background includes a B.S. degree in sales management from Syracuse University. He has been active in chapter affairs on the executive committee and was formerly treasurer and vice-chairman. A member of the Central New York Game Club, he enjoys fishing, bowling and golf. He has two children.

ONTARIO

H. G. WARRINGTON was born in England and educated at Chelsea School of Metallurgy (London University) and later qualified as a Fellow of the Institute of Metallurgists. He began his career as production metallurgist with High Duty Alloys Ltd., and worked for this company in France, Poland, Czechoslovakia and other European countries.

In March 1948, Mr. Warrington came to Canada to start a wrought products division for Dominion Magnesium Ltd., subsequently became technical director and is now manager of the sales department and technical services at Haley, Ont. He is also vice-president of Aerometal Products and Designs Ltd. of Toronto.

Mr. Warrington has published a number of papers on magnesium and aluminum production and fabricating, one of which gained the Diploma of the Institute of British Foundrymen.

RICHMOND

CARSON L. BROOKS, a native of Rochester, N. Y., received his B.S. degree in electrochemical engineering from Massachusetts Institute of Technology. After six months working as a chemist he started his career as a metallurgist in the light metals field with the Aluminum Co. of America. He was plant metallurgist in Massena, N. Y., for seven years, and during World War II transferred to Newark, Ohio, where he has worked on ways and means of reclaiming aluminum scrap, and later transferred to New Kensington, Pa., as assistant chief, Process Metallurgy Division, Alcoa Research Laboratories. In 1955 Mr. Brooks accepted a position with Reynolds Metals Co. in Richmond, where he is now assistant director, Metallurgical Research Laboratories.

His main technical achievements in the light metals field have been in melting, casting and molten metal processing. He also participated in a symposium on gas in light metals at the A.I.M.E. meeting in San Francisco in 1959.

Mr. Brooks has four children, daughter Louise 13, sons Judson 10, Carson, Jr., 7, and Frederick 6. His favorite hobbies are gardening, horticulture and photography.

SAGINAW VALLEY

RUFUS H. BOLT, who was born in Cleveland, Ohio, acquired his formal metallurgical education through extension work from Cornell University and the University of Michigan, with additional work at Central Michigan College. His first job was with Republic Steel Corp. in Buffalo as a ferrous chemist. Later he joined Chevrolet Motor and Axle Division, Towanda, N. Y., as chemist and spectrographer, transferred to Saginaw as laboratory supervisor, then to St. Louis as plant metallurgist and back to Saginaw, where he is now chief chemist-metallurgist.

Chapter activities include service on the executive committee, chairman of the ticket and membership committees, secretary-treasurer and vice-chairman. Mr. Bolt is also a member of other technical and civic organizations. He has three children and calls himself an occasional bowler and golfer.

T. A. Crosby *H. G. Warrington* *J. G. Kura* *R. H. Bolt* *C. L. Brooks*

Utah Officers and Executive Committee Meet

Shown at a Meeting of the Utah Chapter's Officers and Executive Committee Are Members and Guests at Brighton Ski Resort, Where a Special Luncheon Was Held. Shown are, front row, from left: Mrs. Kluck, Mrs. Kron, Mrs. MacKay, Mrs. Kerr, Mrs. Galarneau, Mrs. Lorig, Mrs. May, Mrs. Bateman, Mrs. Warner, secretary, Mrs. Carrera and Mrs. Zeldin. In the back row, from left, are: D. W. Player, R. S. Kluck, R. O. Kron, treasurer, B. R. MacKay, second vice-chairman, R. E. Kerr, J. R. Galarneau, A.S.M. National President C. H. Lorig, J. F. May, chairman, R. G. Bateman, J. M. Carrera, vice-chairman, and C. A. Zeldin

Speaker: C. H. Lorig
Battelle Memorial Institute

Utah Chapter officers, members of the executive committee and their wives joined C. H. Lorig, technical director, Battelle Memorial Institute, and national president A.S.M., at Utah's famous 10,000-ft. elevation Brighton Ski Resort for a special luncheon meeting. After the luncheon, Dr. Lorig discussed national headquarter's plans in conjunction with local chapter activities and other national headquarters news. Complete details of the Chapter's fall educational program were also given.

Following the special meeting, the group journeyed to Salt Lake City where they were joined by all Utah Chapter members and their guests for a dinner meeting, during which Dr. Lorig gave a technical talk entitled "Selection of Materials in This Changing World." Since the subject dealt with special metals being utilized in the aircraft and missile programs around the Utah area, it was a timely talk enjoyed by all members present.

The following day Dr. Lorig and his wife toured the facilities of U. S. Steel Corp.'s Columbia-Geneva Steel Division, Geneva Works Steel plant, which is located 40 miles south of Salt Lake City.—**Reported by LaMar D. Scott for Utah.**

A.S.M. has created the Metals Engineering Institute, the home study school of the metals industry.

Compliments

To ARNE E. UITTI, vice-president and general manager, Lindberg Steel Treating Co., on being awarded an honorary master of engineering degree at the Annual Honors Convocation of Michigan College of Mining and Technology in May. Mr. Uitti is a charter member of both the Michigan Tech and Chicago-Western Chapters, and is active in the Chicago Chapter.

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To CHARLES L. MCCABE, on being named head of the department of metallurgical engineering at Carnegie Institute of Technology, replacing Robert F. Mehl, who is retiring as head of the department so that he can devote more time to research.

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To H. MAUZEE DAVIS, professor of chemical metallurgy at Pennsylvania State University, on being cited for excellence in teaching at the 1959 Commencement Exercises. The citation was accompanied with a $100 award.

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To MORRIS KIBRICK, metallurgist for Purolator Products, Inc., on being selected as the 1959 winner of the product design award given by *Materials in Design Engineering.* Mr. Kibrick's award was for the design of a fibrous porous metal filter disk.

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To LAMAR J. VIEAU, JR., former president, Houston Heat Treating Co., and secretary-treasurer of Texas Chapter, on establishing the Vieau Engineering Co., which represents several manufacturers in the Houston area.

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To EDWARD EGLOFF and ROBERT E. GRAPER, members of Los Angeles Chapter and formerly with Natural Gas Equipment Inc., on the establishment of their own corporation, Egloff & Graper, Inc., at 1798 Industrial Way, Los Angeles. They will represent important Ohio producers and design and build heat treating equipment.

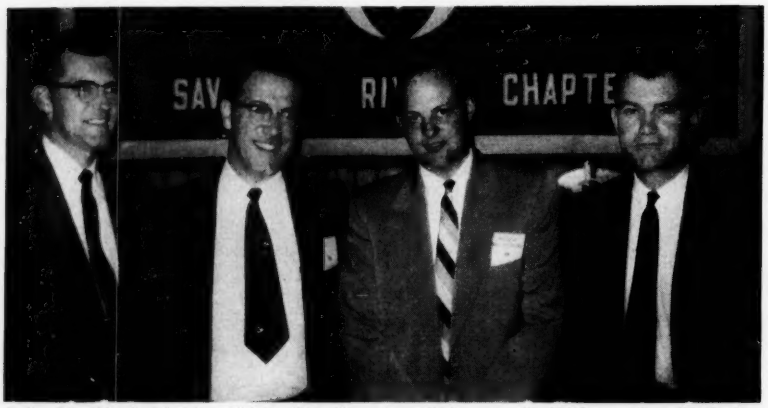
Chapter Press Guides Mailed To All Publicity Chairmen

The new revised A.S.M. Chapter Press Guide, designed to assist local chapters in promoting effective relations with the press, radio and television, was mailed Sept. 4 to each chapter's publicity chairman.

An introduction to the guide, by T. C. DuMond of the A.S.M. staff, points out some of the advantages and opportunities in good chapter public relations. The guide contains biographies and photographs of Society officers, facts regarding the Society, details of the new building and a series of suggestions for chapter publicity chairmen.

A press guide innovation is the check chart on the inside cover, listing helpful steps in developing news stories. Completing the new guide are sample news releases and blank news release forms.

Cites Advances in Tube Manufacture



John J. Rutherford, Chief Metallurgist, Babcock & Wilcox Co., Tubular Products Division, Discussed "New Developments in Tubing Manufacture" at a Meeting Held by the Savannah River Chapter. Shown are, from left: A. D. Fentzke; Mr. Rutherford; R. F. Mittelberg; and W. G. Holmes

Speaker: J. J. Rutherford
Babcock & Wilcox Co.

"New Developments in Tubing Manufacture" were described by John J. Rutherford, chief metallurgist, The Babcock & Wilcox Co., Tubular Products Division, at a meeting of the **Savannah River Chapter.**

After describing, with illustrations, the manufacture of specialty tubing, from the melting of steel to the finished seamless or welded tube, Mr. Rutherford discussed the development of nuclear tubing.

During the first decade of the useful application of atomic energy, the tubing industry was able to supply stainless steel piping to meet the rigid requirements of the remote-controlled, chemical processing at Oak Ridge and Hanford. In the Savannah River project, this took a different aspect and required large quantities of heat exchanger tubing of stainless steel for chemical processing.

The second decade of atomic energy involves the industrial conversion to power of the fissionable products from these chemical processes. It started with the famous submarines Nautilus and Sea Wolf which use pressurized water and sodium as heat exchange media. This was followed by Shippingport, and now a number of electrical power plants are under construction. These carry an additional hazard of proximity to dense population and require freedom from leakage of radioactive materials under conditions of high temperature and high stress.

As activity continues in the area of nuclear power development, new codes and material specifications are being written. The main features which designate nuclear tubing today are: special composition requirements, such as restrictions on tantalum, cobalt, boron, etc.; and special tests for cleanliness, corrosion resistance and integrity. The manufacturing practices for melting stainless steels and making tubular products are constantly being reviewed to the end of making a better engineering component to convert useful nuclear power.—**Reported by R. P. Marshall for Savannah River.**

Bureau of Standards To Publish Four-Part Journal

The *Journal of Research of the National Bureau of Standards* will henceforth contain detailed reports of investigations, authoritative review articles and abstracts of articles by staff members appearing in other journals. It will be published in four sections, as follows:

Section A: Physics and Chemistry; issued bi-monthly at $4.00 per year ($4.75 foreign). Its major emphasis will be standards of physical measurements, fundamental constants and properties of matter.

Section B: Mathematics and Mathematical Physics; issued quarterly at $2.25 per year ($2.75 foreign).

Section C: Engineering and Instrumentation; issued quarterly at $2.25 per year ($2.75 foreign). It will be of value to the engineer and applied scientist, and include properties of engineering materials and information on building research.

Section D: Radio Propagation; issued bi-monthly at $4.00 per year ($4.75 foreign).

Subscriptions should be placed through the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Discusses Arc Cast Molybdenum

"Arc Cast Molybdenum and Its Alloys" Were Covered in a Talk Given Before the Richmond Chapter by R. R. Freeman, Climax Molybdenum Co. Shown at the meeting are, from left: L. D. Bylund, yearbook committee chairman; C. L. Brooks, vice-chairman; J. B. Gooch, Richmond Bureau of Fire, coffee speaker; Mr. Freeman; and J. A. Burke, Jr., chairman of the chapter

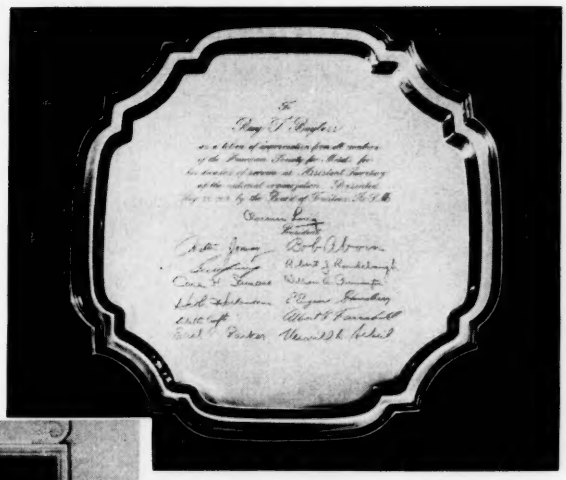
Speaker: R. R. Freeman
Molybdenum Metal Div.
Climax Molybdenum Co.

R. R. Freeman, development manager, Molybdenum Metal Division, Climax Molybdenum Co., presented a talk before the **Richmond Chapter** on "Arc Cast Molybdenum and Its Alloys".

After presenting production figures, Mr. Freeman reviewed the arc process and fabrication of molybdenum as well as its more important physical and chemical properties. Current areas of interest, such as mechanical properties and strength at high temperatures, were presented. A new alloy, consisting of 70% molybdenum and 30% tungsten, is of interest in the missile field. Crystal transition characteristics and forming aspects were touched upon. Applications of molybdenum from radar devices to its use as structural members in missiles were outlined.

A breakthrough in the casting of molybdenum at the Bureau of Mines was also mentioned by the speaker although it is not yet developed commercially.—**Reported by Patrick H. Woods for Richmond.**

Ray T. Bayless Honored By Staff and Board Of Trustees Upon His Retirement From A.S.M.



Guests of Honor at the Testimonial Dinner Given to Honor Ray T. Bayless Upon His Retirement After 37 Years of Service to the American Society for Metals Included, From Left: Son Tom and His Wife, Mrs. Bayless, "Doc", and Mrs. W. H. Eisenman. The plate pictured was signed by members of the Board of Trustees and presented on another occasion to Mr. Bayless

Ray T. Bayless, who retired Sept. 1 as A.S.M. assistant secretary, has been honored twice by the Society to which he has devoted 37 years.

The Wade Park Manor in Cleveland was the setting Aug. 20 as 75 staff associates gathered to present Mr. and Mrs. Bayless an illuminated citation of affection signed by most of the 123 A.S.M. staff members. E. E. Thum, editor-in-chief of *Metal Progress,* made the presentation. Pictures were shown of the Bayless'es activities through the years with the Society.

Four nights later the Board of Trustees feted Ray with dinner at the Hillbrook Country Club. A silver tray bearing an engraved tribute and the trustees' signatures was presented by Clarence H. Lorig, Society president.

In acknowledging this expression by the trustees, Mr. Bayless said he "was only retiring, not quitting . . . ready to do anything he can" for the Society in the days ahead.

Ultra-High-Strength Steels Reviewed at Indianapolis

Speaker: R. W. Lindsay
Crucible Steel Co. of America

R. W. Lindsay, Crucible Steel Co. of America, presented a talk on "Ultra High-Strength Alloy Steels" at a meeting held by the **Indianapolis Chapter.**

Mr. Lindsay first developed the relationship between carbon content and strength level for quenched-and-tempered steels, basing this relationship on a normal silicon content and a tempering temperature of 400° F. He pointed out that the increase of carbon to bring about increase of strength resulted in certain drawbacks with respect to ductility, toughness, notch sensitivity, formability, weldability, retention of austenite and decarburization.

Changes in mechanical properties incurred upon tempering hardened steels were illustrated. The minimum in notched-bar impact toughness, which occurs at 500 to 600° F., was emphasized, and the ways of combatting it, namely—choice of tempering temperature combined with adjustment of silicon content, were discussed. The original contributions in this area of Crucible's research staff were reviewed.

The speaker briefly discussed experimental development within his company of a steel with 340,000 to 350,000 psi. ultimate strength, 290,000 to 300,000 psi. 0.2% offset yield strength, and seemingly adequate ductility and toughness. The talk was concluded by reviewing the work now going on in many quarters concerning the improvement of properties of ultra-high-strength steels by deforming metastable austenite prior to transformation to martensite.—**Reported by Dorothy Holbrook for Indianapolis.**

To Hold Meeting

A three-day meeting on Shaping of Sheet Metal and Testing of Sheet will be held in Paris starting May 23, 1960, to which contributions are invited from American metallurgists. Those interested should address: S. Garber, secretary of the International Deep Drawing Research Group, Hoyle St., Sheffield 3, England. Sessions will be devoted to the theory of forming, to sheet metal testing and to new techniques of forming.

CANADIAN LUNCHEON NATIONAL METAL CONGRESS AND EXPOSITION

The annual Canadian Luncheon will be held Wednesday, Nov. 4, 1959, in the Crystal Room in the Sherman Hotel at 11:30 a.m.

There will be a Canadian headquarters room at the Sherman beginning Sunday, Nov. 1.

Defines Hardenability Relationships

"Hardenability Relationships" Were Defined by Walter E. Jominy, National Secretary A.S.M., at a Meeting in Ontario. Shown are, from left: J. H. Pope, past chairman; Mr. Jominy; and H. G. Warrington, Chapter chairman

Speaker: W. E. Jominy
National Secretary A.S.M.

Walter E. Jominy, national secretary A.S.M., presented a talk at the Annual Meeting of the **Ontario Chapter** on "Hardenability Relationships".

Defining hardenability as a property of steel that determines the depth and distribution of hardness after heat treatment, Mr. Jominy pointed out that the principles of hardenability and necessity for its evaluation were of universal acceptance. The "end quench" test has now been described by all metal societies, such as A.S.M., A.S.T.E., A.I.S.I., S.A.E., etc., and is now recognized as a form of specification by which constructional steels may be purchased. Some 85 steels are now included in the "H" band requirements which define specific limits of hardenability over a full range of quenching rates.

End quench test results have been related to hardnesses obtained in quenching round bars. While the accuracy of this relationship has been challenged in papers by Troiano, Bailey and French, each of whom compared the specific properties of SAE 2340, 1340 and 5140, Mr. Jominy explained that the end quench test does give sufficient information for predicting properties in round bars. The actual quenching operation of round bars can involve irregularities such as scale on the bar, condition of quenching oil, technique of quenching, etc. It is more likely that closer duplication and thus accuracy of hardenability interpretation can be made with the end quench test which thus provides a suitable yardstick for permitting substitution of one steel for another.

Mr. Jominy discussed other properties in steel, such as impact and endurance limits. While the former property can be of concern in some applications, the automotive engineer finds endurance properties to be of major importance in selecting specific grades of steel. All alloy constructional steels possess the same tensile strength and endurance limit at a given hardness level when properly heat treated in the 200 to 400 Brinell range. At hardnesses above 400 Brinell, the 0.40% carbon grades fall off in fatigue strength, and the 0.50% carbon steels do not show a drop in endurance until reaching a hardness of 500 Brinell. This is of great importance in selecting steels for jobs where high strength is required and fatigue life is of importance.

Hardenability properties for various 0.40% carbon alloy grades were illustrated to show the size of the largest bar that would through harden when a given grade possessed hardenability at its lowest and highest extremes. For best uniformity and duplicity of results, the spread in these bar sizes should be minimized. One of the better grades in this respect was the SAE 4047H, which shows a bar size spread of 0.400 to 1.250 in. diameter. This particular factor can be related to the spread in the "H" band. Thus, if we quench two similar bars of a given grade of alloy steel in which the hardenability is at the top side in one instance and at the bottom side in another, the half radius hardness may differ as much as 10 points Rockwell "C". This difference can drop off as the steel is tempered, but may still be as much as 5 points even at a 1200° F. draw. This indicates the problem of obtaining closely restricted properties in the heat treatment of alloy steels when various heats of steel are being employed, even though such heats may be melted with "H" band specification and heat treatment is carired out with best care.

The need for obtaining a fully martensitic structure to ensure optimum fatigue properties was illustrated by showing the endurance curves for a given grade of alloy steel heat treated to 36 Rockwell "C" with varying percentages of martensite in the structure. This direct relationship illustrates the need for high percentages of martensite for optimum resistance to fatigue. Mr. Jominy qualified this point to indicate that it was the need for such a structure to exist at the surface of a part, not entirely throughout the section. In fact, preference is indicated for slack quenched softer products in the central section to provide greater ease in post straightening and optimum stress distribution.

—Reported by B. M. Hamilton for Ontario Chapter.

New Orleans Chapter Officers Meet

Chapter Officers of the New Orleans Chapter Include, From Left: Emerson Kemp, Vice-Chairman, Kaiser Aluminum & Chemical Corp., Chalmette Works; L. L. Newman, Secretary-Treasurer, Newman Engineering Co.; J. L. Shutek, Chairman, Kaiser Aluminum & Chemical Corp., Chalmette Works; Frank O. Ransom, Program Chairman, Kaiser Aluminum & Chemical Corp.

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers: c/o A.S.M., Metals Park, Novelty, Ohio, unless otherwise stated.

POSITIONS OPEN

East

METALLURGIST: For research engineering department. College graduate with automotive experience, particularly in regard to material specifications. Salary range from $7000 to $9000. Send resume to: R. B. Bicknell, Executive Engineer, Research Dept., Mack Trucks, Inc., 1120 S. Second St., Plainfield, N. J.

PLANT MANAGER: For large commercial heat treating company, with good metallurgical education and experience. Familiar with heat treating processes and equipment. Must be capable of supervising operations and conducting an efficient well-managed plant. Excellent, long-time opportunity for well-qualified man. Salary according to ability. Write specifications fully, with photo. Box 9-5.

DESIGN ENGINEER: Familiar with heat treating furnaces, equipment and shop practice. Originality and versatility valued. Interesting, permanent opening with leading small business. State qualifications fully. Box 9-10.

METALLURGICAL ENGINEERS: Several, with from two years experience and up, to fill newly created research and development positions. Conventional and advanced areas in reguline and powder metallurgy being investigated for private and government sponsors. Work is being carried on in laboratory in Metropolitan New York area. Send resume and salary requirements to: Strochheim Research and Development Corp., 34-32 57th St., Woodside 77, N. Y.

METALLURGIST: B.S. in metallurgy or equivalent education and a minimum of five years industrial experience. To act as consultant to design and manufacturing engineers in the application of wrought and cast aluminum and magnesium alloys. Should have experience or an interest in the preparation of material specifications and engineering documents. Laboratory experience desirable. Mail details of experience. Box 9-15.

INVESTMENT CASTING OPPORTUNITY: Large investment casting foundry casting parts in excess of ten pounds needs a man experienced in gating and risering of parts of this size. Induction melting experience would also be desirable. Excellent working conditions and fringe benefits with opportunity for continued advancement. Salary commensurate with ability. Box 9-20.

EXCELLENT OPPORTUNITY: For engineer to join national staff of Society in New York City. Responsibilities to include representation on technical committees, editing of standards, answering technical inquiries from industry. Applicant must have degree in engineering, with at least one year experience, preferably in welding or allied fields. Salary commensurate with qualifications and experience. All replies held in confidence. Box 9-120.

Midwest

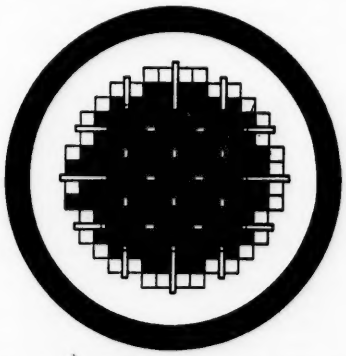
SALES ENGINEER—POWDER METALLURGY: Prefer man with technical and production experience. Sales experience valuable but not necessary. Contacts are in all phases of iron and associated metal powders and in vacuum metallurgy. Midwest, preferably between Chicago and Detroit. Box 9-25.

METALLURGICAL ENGINEER: With 3 to 10 years experience, for alloy development and process development work in aggressive company engaged in manufacture of specialty alloys. Experience in high-temperature alloys and refractory metals desirable. Good opportunities for advancement to supervisory position. Send resume. Box 9-30.

METALLURGIST: Large modern steel foundry in Milwaukee, Wis., has opening for metallurgical project engineer. Prefer recent graduate with growth potential to train for management position. Position will deal with variety of foundry situations and offers excellent practical experience with a leader in the steel foundry field. Submit complete resume. Box 9-35.

MECHANICAL ENGINEER—TOOL ENGINEER: With research experience, for supervising research in the punching of sheet steels. Salary commensurate with training and experience. Large research laboratory in Pittsburgh area. Forward complete resume and salary requirements. Box 9-40.

METALLURGICAL ENGINEER: Graduate. Experience in low-alloy and austenitic high-temperature alloys preferred, but will consider recent graduate. Assignment in process control laboratory of major automotive parts manufacturer. Work covers forging, cold forming, heat treating methods. $6500/9600. Cleveland. Box 9-115.



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Mr. P. W. Christos, Div. 43-MI, Aircraft Nuclear Propulsion Dept.

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METALLURGICAL ENGINEER: B.A. degree in metallurgy, advanced study. Age 31, married, two children, veteran. Seven years experience in metallography, mechanical testing, customer failure analysis. Familiar with ferrous, nonferrous and high-temperature alloys. Would consider research and development. Desires work in East. Resume on request. Box 9-50.

METALLURGIST: B.S. degree, veteran, family. Desires work in Washington, D. C. Three years experience in alloy development. Junior in law school. Wishes to be affiliated with company which can use both legal and engineering background, in position outside research. Available immediately. Box 9-55.

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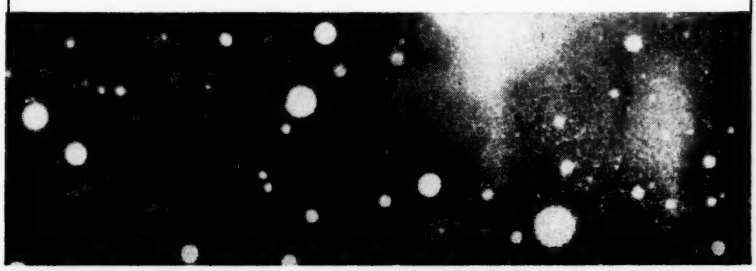

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METALLURGIST: With seven years diversified experience in development and quality control including processing and testing of titanium alloys, stainless steels and nickel-base alloys. Age 29, B.S. degree plus some graduate work. Presently chief metallurgist for multi-plant producer of aircraft engine parts. Seeks responsible position with managerial growth potential. Box 9-70.

METALLURGICAL ENGINEER: Age 30, married, family. Seven years experience in research and development on high-temperature and other current materials. Background includes powder metallurgy, material evaluation and project supervision. Desires challenging position involving non-routine work with opportunities for advancement. Cleveland area. Box 9-75.

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METALLURGICAL ENGINEER: Six years experience as plant metallurgist for chemical plants. Responsible for corrosion prevention, administration of preventive maintenance program, welding, heat treatment and materials of construction specifications. Experience with applications of plastics, hard facings and coatings. Desires position with company concentrated in Western States. B. S. degree, age 32. Box 9-85.

REFRACTORY METAL METALLURGIST: Graduate mechanical engineer, 12 years experience as project engineer in research and development for powder metallurgy. Excellent experience in flame spraying of cermets. Publications and patents. Married, family, age 43. Desires senior position. East preferred but will consider relocation. Box 9-90.

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Openings for Teaching and Research in Solid State and Thermodynamics-Kinetics Areas. Ph.D. Teaching Experience Desirable But Not Essential. Salary and Academic Rank Open. Reply to:

Head, Dept. of Metallurgical Engineering
Michigan State University
East Lansing, Michigan

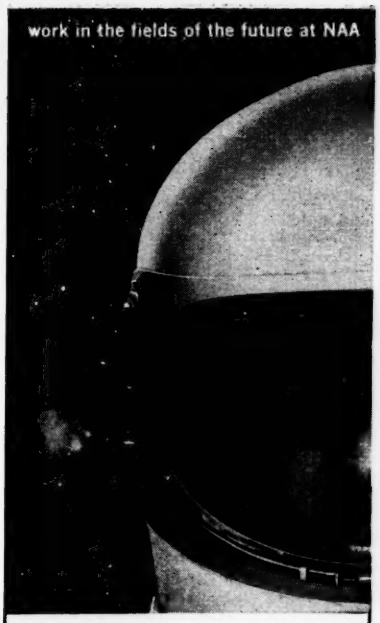
PHYSICAL METALLURGIST
or
METALLURGICAL ENGINEER

B.S. with minimum five years manufacturing experience.

Well versed in heat treat techniques and procedures for ferrous and nonferrous metals. Capable of specifying metals and treatment to specific use. Should be familiar with welding, machining and finishing.

Capable of handling metallurgical aspects of oil well equipment manufacturing plant. Location Southwest.

Salary open. All replies confidential. Send complete resume to:
Box 9-110, Metals Review



PHYSICAL METALLURGISTS

Join one of industry's most progressive teams in exploring the metallurgical frontiers of supersonic flight.

Here are unusual opportunities in applied research for experienced metallurgists who would like to assume increased responsibility and expand their "sphere of influence."

Successful applicants must have the ability to organize and direct the work of others. These positions afford exceptional opportunities for advancement in an expanding materials development program.

Background Preferred: Graduate Metallurgical Engineer with at least four years experience including development or application work in one or more of the following specialties:

Titanium Alloys
Hot Work Die Steels
Superalloys
Refractory Metals
Mechanical Metallurgy
(Sheet Metal Forming)

For more information please write to: Mr. V. S. Stevenson. Engineering Personnel, North American Aviation, Inc., Los Angeles 45, California.

THE LOS ANGELES DIVISION OF
NORTH AMERICAN AVIATION, INC.

METALLURGISTS
for
Materials Engineering

This position requires a BS degree in metallurgical engineering. Assignments will be to execute complex metallurgical investigations, analyses, applications. Will be asked to carry out tests on a variety of metals, alloys and metallic processes involved with development, production and service.

Hamilton Standard recognizes the vital importance of metallurgy in the advanced flight vehicle field . . . and is pioneering many new applications for jet and missile components. We offer a modern, fully-equipped Materials Laboratory where the metallurgist will find every necessary facility.

Many benefits including an opportunity for tuition-paid postgraduate study. Generous relocation allowance . . . very desirable New England living.

Reply in confidence to

Mr. A. J. Fehlber

Technical Employment Supervisor

HAMILTON STANDARD

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35 Bradley Field Rd.
Windsor Locks, Conn.

METALLURGIST: M.S. degree, age 40, family. Extensive knowledge of processing and properties of carbon, alloy, tool, stainless and elevated temperature steels obtained through laboratory, plant and customer contact activity. Blast furnace, openhearth, electric and vacuum melting, hot and cold working, heat treating, finishing and inspection experience. Background includes process and product development, quality control, specifications, technical report writing. Publications. Desires senior position with managerial growth. Box 9-100.

METALLURGICAL ENGINEER: B.S. degree, graduate study in industrial management, age 39. Twelve years in steel wire production, familiar with all phases of wire mill processing. Three year liaison engineering in nuclear field. Four years in steel foundry operations. Desires position in manufacturing, liaison or technical sales. Box 9-105.

CHIEF METALLURGIST: Application metallurgy experience for 17 years, including five years as head of metallurgical laboratory. Strong background in advanced techniques of heat treatment, welding, brazing, soldering, finishing and fabrication. Developed purchase and process specifications; responsible for process control. Seeks staff position with producer of non-military products. Present salary $13,000. Box 9-125.

METALLURGIST: B.S. degree, with 20 years experience in a wide variety of metals and user's problems. Experience includes aluminum, magnesium, alloy and stainless steels, titanium and the refractory metals. Desires position with a relatively small company in the East. Box 9-130.

METALLURGICAL ENGINEER: M.S. degree, age 24, family. Experience in alloy development, melting, casting and fabrication of refractory metals. Also one year experience in alloying, melting and evaluation of carbide and nitride-base materials. Desires challenging position in research or development. Location immaterial. Resume on request. Box 9-135.

METALLURGISTS

and

SOLID STATE PHYSICISTS

Scientists with strong interests in high-temperature metals, mechanical metallurgy or solid-state reactions, are needed for challenging research assignments.

Career scientists having Ph.D. or M.S. degrees, plus two to five years experience are preferred, but recent graduates will be considered.

Call ENdicott 1-5400 or send complete resume in confidence to:

J. B. Meyers

THE BRUSH BERYLLIUM COMPANY

4301 Perkins Ave., Cleveland 3, Ohio

DU PONT

REG. U. S. PAT. OFF.

OPPORTUNITIES IN RESEARCH METALLURGY

E. I. DU PONT DE NEMOURS & COMPANY

New opportunities in the growing and important field of refractory metals are now available with du Pont at the Experimental Station in Wilmington, Delaware. A major expansion in alloy development, metal manufacture and mill product processing techniques is being conducted. Trained Ph.D. research personnel in physical and mechanical metallurgy, or those with equivalent research experience, are needed to support this program. These positions offer an opportunity for direct contribution to the development of niobium base alloys and titanium base alloys as well as additional refractory base systems. Please forward resume including details of education, experience and salary expected to Mr. Harry Joslyn, Employee Relations Department, E. I. du Pont de Nemours & Company, Wilmington, Delaware. Replies held confidential.

RESEARCH METALLURGISTS
MATERIALS ENGINEERS
CERAMIC ENGINEERS
SOLID STATE PHYSICISTS

Advanced Technology Laboratories currently can offer a number of senior and junior grade positions in connection with materials research and development programs in the nuclear field.

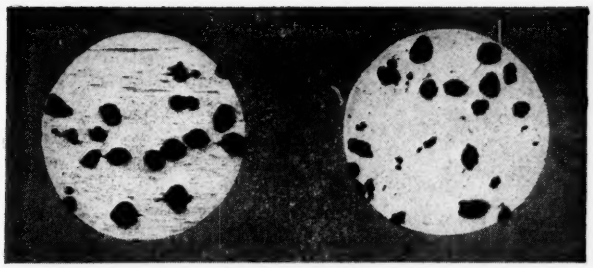
Opportunities exist for metallurgists, ceramic engineers and solid state physicists to carry out both basic and applied research in connection with fuel element development programs. Materials engineers are needed for several advanced reactor design projects. A number of interesting investigations are currently in progress covering the fields of mechanical metallurgy, alloy development, and ceramic fabrication techniques.

Send resume, in confidence, to Dean W. Townsend, American-Standard, Advanced Technology Laboratories, 369 Whisman Road, Mountain View, California.

ADVANCED *Technology* LABORATORIES
A DIVISION OF AMERICAN-Standard

A Study in Applied Creativity at KAPL — directed to Engineers & Scientists to whom an environment of academic freedom is of first importance...

NARROWING THE "DEPARTURE FROM IDEALITY" IN DISPERSION FUEL DEVELOPMENT



† Longitudinal section of 200-μ UO_2 dispersed in Zircaloy matrix. 30X. BF. Reduced approximately 38% for reproduction.

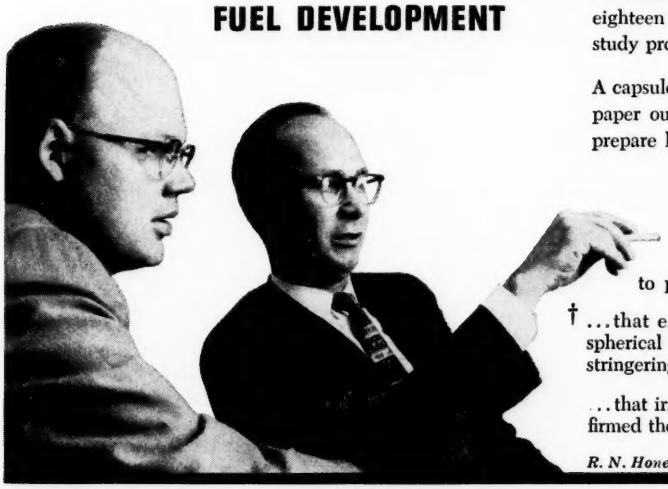
Transverse section of 200-μ UO_2 dispersed in Zircaloy matrix. 30X. BF. Reduced approximately 38% for reproduction.

Scientists have long been cognizant of the theoretical advantages of applying the dispersion theory to reactor fuel elements. Ideally this concept could be utilized to extend substantially fuel rod life in high performance water cooled reactors.

But it remained for KAPL Metallurgists Dr. A. P. Beard and R. N. Honeyman to solve basic problems of process metallurgy involved and achieve *actual fabrication* of zirconium-alloy base dispersion elements which were a significant step closer to the theoretical ideal.

Encouraged by Dr. C. E. Weber, Manager of Basic Materials Development, and a leading figure in Dispersion Element research — and aided by consultation with specialists in several KAPL laboratories — Beard and Honeyman successfully completed evaluation of the irradiation behavior of their first samples in September 1958, only eighteen months (and 2 volumes of experimental data) after the study program was formally initiated.

A capsule description of their findings appears below. Reprints of a paper outlining the experimental method and techniques used to prepare laboratory samples will be furnished on request.



R. N. Honeyman (l.) and A. P. Beard (r.)

Summary of Findings: Dispersion Fuel Study

... showed that mechanical attritioning could be used to prepare zirconium powder with high corrosion resistance.

† ... that extrusion of dispersions of 200 micron dia. particles of spherical UO_2 & UC could be achieved at 750° C with little or no stringering and no reaction between particles and Zircaloy matrices.

... that irradiation behavior of zirconium base dispersion fuels confirmed theoretical concepts of such systems.

Engineers and scientists who appreciate an environment where free inquiry and creative initiative are encouraged are invited to investigate these immediate openings: **Mechanical metallurgy ★ Mathematical statistics & design of experiments (PhD) ★ Mathematical analysis & computer programming ★ Theoretical reactor physics ★ Experimental reactor physics ★ Advanced numerical analysis (PhD) ★ Advanced engineering mathematics (PhD) ★ Materials irradiations experiments ★ Shielding design ★ Reactor materials development ★ Powerplant performance evaluation ★ Analytical chemistry, X-ray diffraction ★ Applied ceramics ★ Radiochemistry ★ Reactor structural design ★ Primary & secondary systems design ★ Chemical analysis, vacuum techniques ★ Reactor instrumentation ★ Nuclear analysis ★ Reactor operation ★ Computer operations ★ Materials quality control ★ Coolant technology ★ Process development metallurgy**

Send your resume in confidence, including salary requirement. We are interested in your technical achievements and interests.

(U.S. citizenship required)

Address: MR. A. J. SCIPIONE, DEPT. *43-M1.*

Knolls Atomic Power Laboratory

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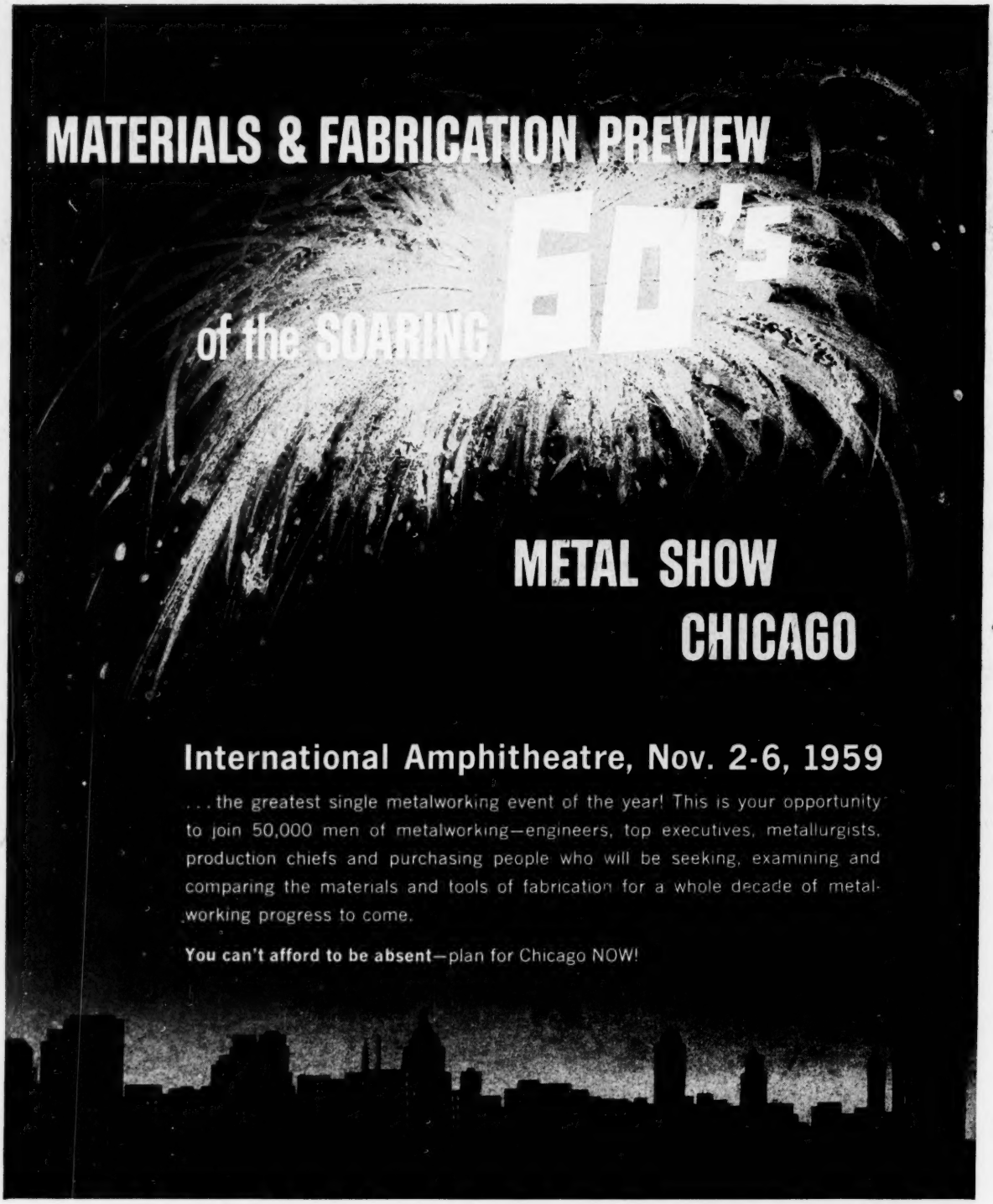

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